

STATINTL

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2 September 1964

MEMORANDUM FOR: DAD/OCS  
Chief, Operations Division  
Chief, Plans Staff

SUBJECT : Projected Requirements for Processing on  
IBM-1401 and IBM-1410, September 1964--  
December 1965.

1. Chart 1 (attached) lists monthly hour estimates of IBM 1410 utilization per job for selected months through December 1965. The estimates for present jobs are based on quite reliable factors and thus, at least in total, the chart should reflect a fairly accurate but conservative prediction of future requirements. A modest amount, 1-45 hours per month, is estimated for hitherto unidentified applications. Maintenance time is not included and must be considered as another 40-50 hours per month which is not available for usage by OCS.

2. The totals on the chart (hours based on current 1410 configuration of 40K, 600 LPM printer, and MOD 5 tape units) show a rapid increase in utilization from 309 hours in June 1964 to 540 hours in December 1964. A less, but still significant rate of increase, continues throughout 1965; and this lesser rate of increase very possibly is a reflection of the conservative estimate for future and yet unidentified requirements.

3. Monthly computer usage figures in a given shop must be interpreted with emphasis on considerations of the job mix ratio of fixed schedule versus ad hoc machine runs. In the extreme case of a shop with all neatly dovetailed fixed scheduled runs, presumably all production requirements up to 480 hours a month (allowing 48 hours maintenance) could be met in a three-shift (528 hours) operation. In a

-2-

shop with ad hoc top priority requests, it is probable that occasionally several of these ad hoc requests will be made simultaneously, and thus, customers will be unhappy. In OCS many priority jobs require a large number of hours and thus the probability of an unhappy customer is greatly increased. OCS must set a compromise policy of a maximum average projected utilization time for our run and priority mix. Projected usage greater than this average would indicate some action to be taken, such as lowering priorities of selected jobs or increasing the hardware capability.

4. Past production performance indicates that a monthly utilization of 300 hours with third shift availability provides reasonably adequate answering of ad hoc priority requests. The acceptability of the production performance rapidly decreases with an increase in the average utilization and at 375 hours per month, OCS can expect many unhappy customers. Above 400 hours per month OCS will have a degenerating situation in which programmer/analysts will be wasting considerable time trying to provide partial answers to ad hoc requests.

5. Recently IBM reduced the overtime rental to 30% of prime time, and since this 30% in reality applies only to the central units, a large monthly usage produces a very attractive computing power per dollar ratio. However, OCS cannot let this attractive overtime pricing be a crippling deterrent to the policy of answering priority ad hoc requests. Future OCS hardware plans should assume a planned maximum of no more than 300-330 hours per month.

6. Using the totals of Chart 1 as a base, Chart 2 gives estimates of the projected monthly utilization in hours per selected months for 13 possible hardware configurations. Also given is the monthly hardware rental based on these estimates and on current rental factors.

7. One obvious recommendation which can be drawn from this chart is to lease the acceleration feature immediately. In all cases it would reduce monthly rental per production output, but most important it would give extra processing hours.

-3-

8. If the hours per month per configuration estimates and the above suggested monthly use maximums are valid, OCS must begin upgrading its 1410 complex immediately. Even the immediate ordering of the acceleration feature as an addition to the orders for the 40K additional memory and the one/100 LPM printer, will not avert an OCS crisis by April 1965. Two possible general configurations exist to upgrade the IBM-1410 for the 1965 workload and a choice and an order should be placed now.

a. One IBM 7010, 80-100K, Mod 5 or 6 tape units giving a good capability of doing the projected OCS workload for approximately \$30,000 per month. Various gradations of components exist within this system giving varying capabilities of meeting priority ad hoc requests (see Chart 2).

b. Two IBM 1410's, 60-80K, Mod 5 tape units giving an excellent capability for doing the projected workload and for meeting priority ad hoc requests at a cost of \$43,000--45,000 per month.

9. Recommendation of IBM 7010. Several jobs exist which demand top priority ad hoc processing. However, unless OCS can ascertain that the priority of at least one of these jobs alone justifies the second IBM 1410 as backup, an IBM 7010 must be recommended for lease in March 1965. The large price difference could not be justified nor rationalized in any other way.

The hardware is 100% compatible with our present configuration. Our present software (OPS and non-OPS) is 100% compatible and software which would be written in OCS for the 7010 would be largely compatible with most third generation machines.

10. Peripheral Support to the IBM 1410 and IBM 7090.

Peripheral Support to the 1410 and 7090, which is presently done on the 1401, consists largely of printing. Also most production jobs which had been programmed for the 1401 are printer I/O bound. Both types of production

-4-

frequently are run on the 1410 to answer hardware malfunction or peak load conditions on the 1401. The 1401 is now at peak capacity and is utilized nearly 400 hours\* per month. At various processing points during the running of some large priority ad hoc 1410 jobs, print image tapes are produced which in practice must wait to be printed on the 1410 after normal run completion because the 1401 is saturated with printing from the 7090. This produces a linear sequence rather than parallel processing. An additional print thruput channel must be acquired to provide output in reasonable time.

11. Optional Solutions for Extra Printing Capability.

a. IBM 1460--Replacement of 1401 giving 1100 lines per minute instead of 600 at approximately same price. All hardware and software would be compatible.

- (1) PRO--Nearly double thruput per dollar.
- (2) CON--Only one channel for thruput. In practice would greatly help 7090 turn-around time, but do little for 1410. At least one job scheduled for future will use 120 character print chain which fits only on 1401.

b. IBM 1460 as an addition to hardware complex.

- (1) PRO--Additional 1100 lines per minute extra thruput. 1401 still available for 120 character print chain.
- (2) CON--Cost (\$8,000) is high. As an additional unit a very low turnaround time priority would be required to justify such a high cost. Very little of the extra computing power available could be utilized.

\*Utilization = Clocktime/0.70

-5-

c. Second printer added to 1410.

(1) PRO--Additional print capability for approximately \$2,300.

(2) CON--Software to work this capability into OPSYS is poor. Very probable that the net print speed would be reduced to 200-400 lines per minute. Also most certainly some thruput speed would be sacrificed on the simultaneous processing programs. All factors considered, additional printing per dollar would probably be low and operational management would be difficult.

d. IBM 1440--As an addition, composed of CPU, console, TU, and 1100 LPM printer.

(1) PRO--Cost (\$3575) very high thruput per dollar. The additional thruput channel would alleviate multiple peak load conditions. Very good capability for data transmission support through addition of Tele-unit at \$250. Software is available and good.

(2) CON--Little capacity for computing backup without special programming.

e. Stromberg-Carlson 4020.

Converts magnetic tape digital signals into alphanumeric printing, curve plotting, and line drawings on microfilm and/or photo paper at high speeds. By adding a Xerox Copyflow, hard copy can be produced from the standard microfilm rolls. Total equipment cost is \$214,000 which equates to roughly \$6-7,000 monthly rental. (For comparison purposes.) For further specifications and possible uses see Memo for Chief, Applications Division; Subject: Equipment to Reduce Costs of Producing Computer Output; by R. D. Hicks; dated 9 March 1964.

-6-

(1) PRO--Microfilm and plotting capability possibly could be useful. Single hard copy processing is comparable, being cheaper than the 1460 or 1401 during prime shift (more expensive during second and third shifts).

(2) CON--Turnaround time is slow for hard copy. Cost is expensive compared to 1440 printing. 122,000 lines of hard copy cost \$40.00 (\$20.00 per hour prime time) on 1440 and \$49.00 on SC-4020; however, extra shift rental of 1440 is approximately \$5.00 per hour. N-copy listings must be processed n-times with the resultant further increase in cost.

f. Honeywell-200 (an addition).

Essentially a copy of the IBM 1401/1460, reputedly more flexible and with better performance. Cost for a stripped 2K system with TU and a 900-1260 LPM printer is \$3,040 per month. This expanded to a 4K system (add \$250) and with the editing feature (add \$90) costs \$3380 and allows use of the SCOPE software package which handles all typical peripheral usage.

(1) PRO--High processing power per dollar ratio. Software is good and 1401 software can be run in compatibility if H-200 is expanded to 8K. The print speed range of 900-1260 permits more lines per minute than the IBM 1403-3 when the character set used is mostly digits or blanks. Additional computing power is available in the 4K memory. Present customers generally are well pleased with overall performance.

(2) CON--M-H hardware and software in past has generally been considered to be inferior to that of IBM. The present claims to performance are being verified by new customers, but some residual reluctance is prudent.

-7-

g. CDC-8090 (an addition).

The CDC-8090 is essentially a cheaper, more compact, more flexible version of the reliable CDC-160A. CDC now has its own 100-LPM printer which has been performing reliably for 15 months. Quality of print is good but slightly inferior to that of IBM 1403. The CDC 8090 is one of the most adaptable peripheral I/O devices for a larger computer on the market. A standard software package will run four 1000 LPM printers and a card/punch simultaneously on unit record image data (print controls can be used) at the same time at full speed. Rental price for 4K-8090 with one printer is \$3445.

- (1) PRO--High processing power per dollar ratio. Software generally is good and specifically, software for handling unit-record images is excellent. Additional 1000 LPM capability can be added for \$1600 per month (maximum 4) with no change in software. Very reliable performance.
- (2) CON--Slightly more expensive than H-200 (\$65.00 per month). Printer output slightly inferior to IBM 1403. Capability to process non unit-record image data would require extra programming.

12. Recommendation of CDC 8090. Even though the IBM 1440, H-200 and the CDC 8090 are very close in performance and price, the CDC 8090 is recommended as first choice for the following reasons:

- a. Reliability--comparable to 1440 and a past performance record superior to Honeywell in hard and software.
- b. Flexibility. More flexible than H-200 or IBM-1440 in unit record image capability. An ever increasing proportion (now 70%) of OCS peripheral printing is unit-record image.



-8-

c. Speed is near top of today's market.

d. Software (for unit-record image) is the best.

e. An additional print thruput channel is provided giving operations a much increased scheduling flexibility. Up to three extra thruput channels (excluding CPU) provide for ease of future expansion.

f. Tape units are compatible with IBM units.

g. The 90-120 day delivery time answers OCS requirements.

h. OCS already has approved a CDC 8090 for a field installation. An 8090 for COMMO is arriving at Headquarters in October for program checkout, and then will be shipped to field. Tentative and unofficial COMMO plans call for a proposal for a second CDC 8090 field installation after appropriate program checkout at Headquarters. A CDC 8090 in OCS available one to two hours per day for COMMO program checkout would cancel the requirement for the Headquarters COMMO installation. (Paper tape-reader and punch required as an extra.)

i. A data transmission capability can be added to CDC 8090 for \$125.

j. The IBM 1401 printing thruput channel in OCS can remain, thus meeting the future requirement for a 120 character print chain.

k. Psychological impact on IBM. Probably the greatest advantage to be derived from the lease of a CDC 8090 (or other non-IBM gear) to be placed next to present IBM equipment would be the competitive jolt given to the IBM sales, systems, and engineer



-9-

forces. Direct comparisons of performance would be valuable to OCS in making decisions about the very important future direction of OCS hardware growth. STATINTL

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## CHART 1

## ACTUAL &amp; Projected Usage of OCS IBM - 1410

(In hours per month)

Compiled by   25 August 1964  
Assumes current configuration

JOB	May 64	June 64	July 64	Sept 64	Dec 64	Mar 65	June 65	Sept 65	Dec 65
	3			1	3	1	1	1	3
	40	60	46	50	52	54	56	58	60
		3		1	1	1	1	1	1
	2	1	3	4	6	6	6	6	6
	3	20	15	10	5	5	5	5	5
	1			1	1	1	1	1	1
	2		10	2	2	2	2	2	2
	7	3	10	16	30	32	35	40	45
	90	67	98	110	120	110	100	100	100
	2		1	1	1	1	1	1	1
				1	1	1	1	1	1
	3	1		2	2	3	3	4	4
	10	10	15	2	2	2	2	2	2
				5	15	5	5	5	5
		2	8	1	1	1	1	1	1
	7	14	37	40	42	44	46	48	50

CHART 1  
Page 2

JOB	May 64	June 64	July 64	Sept 64	Dec 64	Mar 65	June 65	Sept 65	Dec 65
	67	88	81	80	80	80	80	80	80
		5	2	1	2	3	4	5	6
	3								
	1								
	3		1	2	2	1	1	1	1
		3	1	2	2	2	2	2	2
			6	6	6	6	6	6	6
		2	1	2	2	2	2	2	2
	2	1		2	3	3	4	4	4
	9	3		3	3	3	3	3	3
	1		2	1	2	1	2	2	2
	2	1	2	2	2	2	2	2	2
	6			6	6	6	6	6	6
		5	1	1	1	1	1	1	1
	7			2	2	2	2	2	2
	18	10	11	25	8	8	8	8	8

\*Full implementation of monitor with addressable clock will reduce this time to 200?. Time will still be valid but distributed among the jobs.

CHART 1  
Page 3

JOB	May 64	June 64	July 64	Sept 64	Dec 64	Mar 65	June 65	Sept 65	Dec 65
	2			1	1	1	1	1	1
			10	40	70	90	105	120	130
	1	2		2	2	3	3	3	3
			1	1	1	1	1	1	1
		4	5	10	15	20	20	20	20
				15	35	35	35	35	35
				7	2	2	2	2	2
				1	5	15	25	35	45
	3	3	3	4	4	4	5	5	5
TOTAL	295	309	370	463	540	560	585	621	653

\*Applications under study but not yet approved.